

guished from the other two species by its much larger size and deep black colour. It is much the rarest of the three. *T. stigmata* is the only described species of the genus having a male sexual mark on the upperside of the forewing.

II.—Notes on Indian Rhynchota, No. 2.—By E. T. ATKINSON, B. A.

[The notes are taken so far as possible from the original descriptions or from Stål, Signoret, Butler, or Distant, &c. where these writers have redescribed a species. The measurements of specimens not in the Indian Museum have been converted into millimetres from the recorded measurements of the several authors.]

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HOMOPTERA.

Family CERCOPIDÆ.

Cercopida, Stål, Hem. Afric. iv. p. 54 (1866): Hem. Fabr. ii. p. 11 (1869). Fieber, Rev. Mag. Zool. (3 sér.) iii. p. 328 (1875): *Cercopina* Stål, Ofvers. Kong. Vet. Aka. Förh. p. 718 (1870).

Frons convex or compressly produced: ocelli two on the vertex near the base: thorax, large, sexangular or trapezoidal: scutellum small or moderate, triangular; tegmina usually coriaceous: feet remote from the sides of the body with the coxæ (especially the posterior pair) short: tibiæ rounded, posterior furnished with one or two spines and with a circle of spinules at the apex.

Subfamily CERCOPINA, Stål.

Cercopida, Stål, Hem. Afric. iv. p. 55 (1866): Hem. Fabr. ii. p. 11 (1869): *Cercopina*, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 718 (1870).

Anterior margin of thorax straight, eyes equally long and broad.

In 1874, Mr. Butler of the British Museum (Cist. Ent. i. p. 245) recorded the species of the genera *Cosmoscarta* and *Phymatostetha*, formed by Stål from the genus *Cercopis* of Walker (*nec* Fabricius). He enumerated 104 species of the genus *Cosmoscarta* and 22 species of the genus *Phymatostetha*. Since then, the number of species of the genus *Cosmoscarta* has been increased by eight of which five, described by Mr. Distant, come from India and the Eastern Archipelago, and three, described by Mr. Butler, come from Penang and Sumatra. The number

of species of the genus *Phymatostetha* has been increased by two, of which one comes from Ceylon and one from Assam; both have been described by Mr. Distant. The Indian Museum possesses about ten, apparently undescribed, species which may be referred to these genera, and which will form the subject of a separate paper hereafter.

Genus COSMOSCARTA, Stål.

Hem. Fabr. ii. p. 11 (1869) : Ofvers. Kong. Vet. Aka. Förh. p. 718 (1870).

Frons very large, very tumid, obtuse, extended on the facial side almost to the eyes, devoid of any longitudinal furrow or keel.

1. COSMOSCARTA TRICOLOR, St. Farg. and Serv.

Cereopis tricolor, St. Fargeau and Serville, Enc. Méth. x. p. 605 (1825) : Burm. Handb. Ent. ii. (i) p. 124 (1835) : Walker, J. L. S. Zool. i. p. 95 (1856) ; *ibid.*, p. 165 (1857).

Cosmoscarta tricolor, Butler, Cist. Ent. i. p. 245 (1874) : Distant, J. A. S. B. xlviii (2) p. 38 (1879).

Black, shining : head, thorax, scutellum towards the tip, hind borders of the abdominal segments, the tip of the abdomen and the legs, red : femora black, the four anterior red towards the tips : six red spots on each tegmen at the base. A Tenasserim variety in the Indian Museum differs from the type in having the subbasal fascia represented by a transverse series of four sanguineous spots ; there is also a spot of the same colour at the base. It is thus intermediate between *C. tricolor* and *C. basinotata*, Butler (Cist. Ent. i. p. 245), which differs also in the coloration of the abdomen (*Distant*). Body long 22 : exp. teg. 51 millims.

Reported from Borneo, Java, Singapore, and Tenasserim ; a specimen from the last locality is in the Indian Museum.

2. COSMOSCARTA BASINOTATA, Butler.

Cosmoscarta basinotata, Butler, Cist. Ent. p. 245, t. viii, f. 2, (1874) : Distant, J. A. S. B. xlvii (2) p. 194 (1878).

Form of *C. tricolor* : differs chiefly in having the tegmina crossed at the base by a patch of six red spots (that on the clavus being more or less bifid) instead of the pale testaceous band, and in the narrower and interrupted red bands margining the segments on the dorsum of the abdomen (*Butler*). Long. 21 : exp. teg. 47 millims.

Reported from Sarawak, Tenasserim.

3. COSMOSCARTA MOOREI, Distant.

Cosmoscarta moorei, Distant, Trans. Ent. Soc. Lond. p. 321 (1878.)

Black, shining: tegmina with the base both above and below carmine. This coloration consists of a narrow straight subcostal streak of about 3 millims. in length and a broader claval streak of about the same length, gradually rounded and narrowed at its termination: wings fuscous; costal edge, for about half the length, narrowly tinged with carmine: eyes luteous: posterior border of scutellum, metanotum, and abdominal segments, apex and lateral borders of abdomen, carmine: anterior legs dull reddish, femora furnished with a strong spine; intermediate legs pitchy: mesosternum with two very large conical, thick teeth. Body long 13: exp. teg. 35 millims.

Reported from Sikkim.

4. COSMOSCARTA FUSCIPENNIS, St. Fargeau.

Cercopis fuscipennis, St. Farg. & Serv., Enc. Méth. x. p. 605 (1825.)

Cercopis plana, Walker, List Hom. B. M. iii. p. 653 (1851): J. L. S. Zool. i. p. 95 (1856): *ibid.* x. p. 276 (1867).

Cosmoscarta fuscipennis, Stål, Hem. Fabr. 2 p. 11 (1869): Butler, Cist. Ent. i. p. 246 (1874).

Black: head, chest, rostrum except its black tip, and the fore-border of the tegmina from one to two-thirds of its length, red: wings dark grey. Thorax sometimes with two black points. Body long 12: exp. teg. 27 millims.

Reported from Java, Penang, Mount Ophir, Malabar (*Walker*).

5. COSMOSCARTA MEGAMERA, Butler.

Cercopis nigripennis, Walker (*nec Fabricius*), List Hom. B. M. iii. p. 653 (1851).

Cosmoscarta megamera, Butler, Cist. Ent. i. p. 246, t. viii. f. 3 (1874): Distant, J. A. S. B. xviii. (2), p. 38, (1879).

Form and general coloration of *C. fuscipennis* (St. Fargeau), but at once distinguished by its much greater size, black legs, the narrower reddish costal edge and less pronounced basal reddish diffusion on tegmina. The colour of the thorax and head also varies from piceous to castaneous and bright testaceous (*Butler*). Body long 16—19: exp. teg. 39—47 millims.

Reported from Hong-Kong, Laos, Java, Penang, Tenasserim, Silhat: the Indian Museum possesses specimens from Sikkim, Sibságar, Nága Hills, and Tenasserim.

6. COSMOSCARTA FUNERALIS, Butler.

Cosmoscarta funeralis, Butler, Cist. Ent. i. p. 247, t. viii. f. 4 (1874).

Form of *C. fuscipennis*, St. Far. & Serv., but thorax with a distinct central ridge: head and thorax dark castaneous; scutellum piceous,

dorsum of abdomen reddish-orange; tegmina piceous, almost black; wings fuscous; pectus black; venter and legs red; segments transversely banded and laterally spotted with black; proximal extremities of femora blackish (*Butler*). Body long 20: exp. teg. 41 millims.

Reported from India.

7. COSMOSCARTA MASONI, Distant.

Cosmoscarta masoni, Distant, J. A. S. B. xlvii (2); p. 194 (1878): xlviii. (2), p. 40, t. ii, f. 6, (1879).

Pronotum stramineous with a quadrate black spot on the anterior margin: head (except basal portion), and eyes luteous: tegmina, pectus, legs, and abdomen shining black: prosternum with lateral borders stramineous: wings dark fuscous with the veins black ♀. Body long (excl. teg.) 17: exp. teg. 45 millims.

Reported from Burma, Tenasserim: type from the latter locality in the Indian Museum.

8. COSMOSCARTA VIRIDANS, Guérin.

Cercopis viridans, Guérin, Voy. Bél. Ind. Orient. p. 501; Atlas, t. 3, f. 7, 7a (1834): Walker, List Hom. B. M. iii. p. 654, (1851); J. L. S. Zool. x. p. 279, (1867).

Cercopis latissima, Walker, List Hom. B. M. iii. p. 655, (1851).

Cosmoscarta viridans, Butler, Cist. Ent. i. p. 249, (1874).

Black, shining: tegmina shining metallic blackish-green, convex along the fore-margin which is dilated towards the base; wings fuscous, veins black, rostrum, feet, and anus coccineous. Body long 15: exp. teg. 46 millims.

Reported from Coromandel, Java, Sumatra, Mysol, New Guinea.

9. COSMOSCARTA EGENS, Walker.

Cercopis egens, Walker, List Hom. B. M. Suppt. p. 171, (1858).

Cosmoscarta egens, Butler, Cist. Ent. i. p. 255, (1874).

Thorax and head black, shining: scutellum, metanotum, abdomen at the base and along the posterior margin of each segment, and the legs red: tegmina very red at the base and with a roseate band before the reticulated apical third, this band is sometimes narrow or indistinct or even obsolete: wings brown, rosy red at the base and along the adjoining part of the costa. Body long 11: exp. teg. 31 millims.

Reported from India, Penang: the Indian Museum possesses specimens from the Nâga and Khasiya hills.

10. COSMOSCARTA DUCENS, Walker.

Cercopis ducens, Walker, List Hom. B. M. iii. p. 655, (1851): Stål, A. S. E. F. (4 sér.) v. p. 188, (1865).

Cosmoscarta ducens, Butler, Cist. Ent. i. p. 255, (1874).

Black, rostrum and legs piceous; abdomen shining violaceous; tegmina blackish-brown with two narrow, slightly undulating, sordid sanguineous bands; one, near the base; the other, at two-thirds of the length: wings dark brown, veins black. Body long, 16: exp. teg. 40 millims.

Reported from Silhat: the Indian Museum possesses a specimen from the Nága hills.

11. COSMOSCARTA LYDIA, Stål.

Cercopis lydia, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 149, (1865).

Cosmoscarta lydia, Butler, Cist. Ent. i. p. 257, (1874).

Brick red or saffron-yellow: head, anterior part of thorax, scutellum (except the frena), tegmina, anterior lateral part of prostethium, metastethium, anus and tarsi, black: base of the tegmina brick-red or saffron-yellow: wings sordidly hyaline, apex very slightly infusate, base palely saffron. Body long 8—10: exp. teg. 20—23 millims.

Sometimes tegmina have no saffron bands and sometimes have two, one before and the other behind the middle.

Reported from E. India.

12. COSMOSCARTA TRIGONA, Walker.

Cercopis trigona, Walker, List Hom. B. M. iii. p. 660, (1851).

Cercopis amplicollis, Walker, l. c. Suppt. p. 175, (1858).

Cosmoscarta trigona, Butler, Cist. Ent. i. p. 257, (1874).

Thorax metallic bluish-black, shining: borders of scutellum, posterior margin of segments of abdomen, the anus, coxæ and femora, and the tarsi at the base, red: tegmina bluish-black, tips brown, with a bifurcated basal streak and two bands, red; the basal streak with the median band contain between them an almost triangular patch, bluish black: the limb of the basal bifurcation on the hind border is much broader than that on the costal margin, neither quite reach the median band. Body long 10—12: exp. teg. 23—29 millims.

Reported from N. India.

The Indian Museum possesses specimens from the Khasiya and Nága hills, the Dhansiri valley, and Sibságar.

13. COSMOSCARTA DECISA, Walker.

Cercopis decisa, Walker, List Hom. B. M. Suppt. p. 175, (1858).

Cosmoscarta decisa, Butler, Cist. Ent. i. p. 258, (1874).

A second species described under this name by Walker (in J. L. S. Zool. x. p. 278, No. 296, 1867) has been renamed *C. zonata* by Butler (in Cist. Ent. i. p. 253, 1874). Walker describes *C. decisu* thus: "Black: head above and prothorax æneous-green, shining: prothorax

with a very indistinct keel: tegmina whitish testaceous at the base and with two whitish testaceous bands; middle band almost equal in breadth and parallel to the basal one; exterior band contracted hindward: wings greyish-vitreous." Body long $7\frac{1}{2}$: exp. teg. 17 millims.

Reported from Darjiling. The Indian Museum possesses a specimen from Sikkim.

14. COSMOSCARTA UNDATA, Walker.

Cercopis undata, Walker, List Hom. B. M. iii. p. 659, (1851): Stål, Ofvers. Kong. Vet. Aka. Förh., p. 148, (1865).

Cosmoscarta undata, Butler, Cist. Ent. i. p. 258, (1874).

Black: abdomen shining violaceous: thorax and the spots or bands on tegmina croceous or rufous-testaceous; an anterior transverse spot on the thorax and the posterior part, black: wings slightly infuscate, veins rufescent towards the base.

Var. *a*. Posterior half of thorax black: tegmina with almost the fifth basal part, posteriorly sinuated, a waved band a little before the middle, somewhat interrupted towards the claval suture, also a band beyond the middle, produced posteriorly in its middle, sometimes divided into three spots, rufous-testaceous. Body long 13: exp. teg. 30 millims.

This variety is reported from the Himálaya and the Indian Museum possesses specimens from Sibságar, Assam, and Arakan

Var. *b*. about the fourth basal part of the thorax, black: tegmina with a waved band before the middle, twice subinterrupted, emitting at the costal and scutellary margins a stripe, sinuated within, also with three spots disposed in a curved row beyond the middle, the two exterior often confluent, rufous-testaceous. Body long 9—10: exp. teg. 24 millims.

Reported from Penang.

15. COSMOSCARTA BISPECULARIS, White.

Cercopis bispecularis, White, A. & M. N. H. xiv. p. 426, (1844): Walker, List Hom. B. M. iii. p. 656, (1851): Stål, Stettin Ent. Zeit. xxii. p. 153, (1866).

Cosmoscarta bispecularis, Butler, Cist. Ent. i. p. 259, (1874).

Cinnabar, shining: thorax with two very large, nearly oval, black spots in front of which are two small, nearly round, black spots; pectus black; underside of abdomen with two black bands: tegmina with a short black stripe at the base, near which three united black spots form a curved band across the wing; another band is formed in the middle by three separate black spots; reticulated part at the tips brown; wings grey, red at the base, brownish along the hind borders and at the tips. Body long 11—12 exp. teg. 26—29 millims.

Reported from India, Almora, N. W. P., Penang: the Indian Museum possesses specimens from Assam.

16. COSMOSCARTA DORSIMACULA, Walker.

Cercopis dorsimacula, Walker, List Hom. B. M. iii. p. 658, (1851) : J. L. S. Zool. i. p. 95, (1856) : *ibid.* p. 165, (1857).

Cercopis quadrimaculata, Walker, l. c. p. 661, (1851).

Cosmoscarta dorsimacula, Butler, Cist. Ent. i. p. 259, (1874).

Walker's *Cercopis dorsimacula* in List Hom. l. c. p. 663, No. 41, is different and was renamed by him *Cercopis tomentosa* in J. L. S. Zool. x. p. 284, (1867) : it now stands as *Phymatostetha stellata*, Guérin (*q. v.*).

Bright red shining : head with a short transverse streak along each side of the hind border ; thorax with two very large black spots on each side of the disc and two smaller spots in front ; pectus and abdomen towards the base, black : a row of black spots on each side of the abdomen, of which the underside, except the hind borders of the segments, is black ; tegmina red with seven black spots, six large and more or less confluent form two curved bands ; reticulated part lurid : wings lurid, red at the base ; veins brown, red towards the base (*Walker*). Body long 12—14 : exp. teg. 36—39 millims.

Var. *a.* abdominal segments with black bands.

Var. *b.* Body and tegmina testaceous with the usual spots.

Reported from N. Bengal.

17. COSMOSCARTA FICTILIS, Butler.

Cosmoscarta fictilis, Butler, Cist. Ent. i. p. 259, (1874).

Allied to preceding but differs in its usually smaller size, narrower thorax, duller and more uniform colouring and much smaller and more regularly uniform black spots (*Butler*). Body long 12 : exp. teg. 32 millims.

Reported from Penang, India, Silhat.

18. COSMOSCARTA DORSALIS, Walker.

Cercopis dorsalis, Walker, List Hom. B. M. iii. p. 658, (1851).

Cercopis connexa, Walker, List l. c. p. 663, (1851).

Cercopis ramosa, Walker, Ins. Saunds. Hom. p. 85, (1858).

Cosmoscarta dorsalis, Butler, Cist. Ent. i. p. 260, (1874).

Walker describes *C. dorsalis*, thus :—“ Piceous shining ; shield very minutely punctured, impressed on each side in front ; tibiæ and feet ferruginous ; tegmina red, black on the reticulated part ; eight large, partly confluent, black spots on membranous part : wings brown, veins black.” Body long 9 : exp. teg. 25 millims.

Reported from N. India.

19. COSMOSCARTA PALLIDA, Walker.

Cercopis pallida, Walker, List Hom. B. M. iii. p. 657, (1851).

Cercopis ferruginea, Walker, List l. c. p. 660, (1851).

Cosmoscarta pallida, Butler, Cist. Ent. i. p. 265, (1874).

Walker describes *C. pallida*, thus:—"Testaceous, head black, transversely striated, very convex in front: rostrum testaceous: abdomen brown, testaceous at the base, and at the tip: tips of the feet brown: tegmina lurid, brown towards the tips: wings grey, veins brown." Body long 11-13: exp. teg. 29-33 millims.

Reported from India.

20. COSMOSCARTA ELEGANTULA, Butler.

Cosmoscarta elegantula, Butler, Cist. Ent. i. p. 265, (1874).

Allied to preceding: head and thorax metallic greenish black: abdomen purplish black, castaneous at the tip: tegmina piceous, veins of basal half testaceous: base and a transverse band at end of second third reddish-orange: wings slightly fuscous; base rufescent (*Butler*). Body long 8: exp. teg. 20 millims.

Reported from India.

21. COSMOSCARTA PICTILIS, Stål.

Cercopis pictilis, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 249, (1854).

Cosmoscarta pictilis, Butler, Cist. Ent. i. p. 266, (1874).

Obscurely green chalybeous; scutellum on both sides at the base and at the apex weakly spotted with cinnabar: tegmina sordidly white, basal margin and two bands weakly cinnabar; two spots, one smaller before the first band and the other between the bands and the apex nigro-fuscous: femora red; tibiæ blackish. Long, 16; breadth of pronotum 6 millims. Butler writes that it seems allied to *P. signifera*, Walker from the description and in that case would be a *Phymatostetha*.

Reported from E. India.

22. COSMOSCARTA BOREALIS, Distant.

Cosmoscarta borealis, Distant, Trans. Ent. Soc. p. 321, (1878).

Head and pronotum luteous, antennæ black: abdomen and tegmina roseate, ocelli black, eyes luteous thickly covered with blackish markings: wings pale fuscous: pectus, coxæ, and femora luteous, fore and median tibiæ black, hind tibiæ luteous with the apex black: the tip of the rostrum, tarsi, and a strong spine near the apex of the hind tibiæ, black. Body long 6: exp. teg. 17 millims.

Reported from the Khasiya hills.

23. COSMOSCARTA ANDAMANA, Distant.

Cosmoscarta andamana, Distant, Trans. Ent. Soc. p. 175, (1878): Waterhouse, Aids Ident. Ins. i. t. 58 (1880-82).

Sanguineous, finely and closely punctured: tegmina with a broad band across the middle and the apex broadly black: these bands are united at the inner margin, sometimes very broadly: wings sordidly hyaline with veins much darker, base slightly sanguineous: femora, tibiæ and tarsi piceous, hind tibiæ with an acute spine (*Distant*). Body long 9: exp. teg. 24 millims.

Reported from the Andaman Islands.

Genus PHYMATOSTETHA, Stål.

Ofvers. Kong. Vet. Aka. Förh. p. 721, (1870).

Frons tumid, seldom forming an angle below the middle, without a keel or longitudinal impression. Ocelli nearer each other than the eyes. Thorax with the posterior margin before the scutellum slightly sinuated posterior lateral margins straight or sinuated. Mesosternum furnished posteriorly with two conical tubercles. Feet moderate, posterior tibiæ armed with one or two spines.

24. PHYMATOSTETHA STÅLII, Butler.

Tomaspis circumducta, Stål (*nec* Walker), Ofvers. Kong. Vet. Aka. Förh. p. 150, (1865).

Phymatostetha circumducta, Stål l. c. p. 721, (1870).

Phymatostetha stålîi, Butler, Cist. Ent. i. p. 267, (1874).

Blackish: frons, apices of the lobes of the vertex, apical and lateral margins of anterior part of the thorax, scutellum before the middle, two bands on the tegmina, equally removed from each other and from the base and the apex, the anterior small stripe on the corium, and the scutellary limbus of the clavus beyond the middle, sordidly lutescent: apical limbus of corium pellucid fuscous: wings fuscous, subsanguineous at the base: scutellum subequilateral; mesostethium with two distinct obtuse tubercles. Body long 14: exp. teg. 34 millims.

Reported from E. India.

25. PHYMATOSTETHA CIRCUMDUCTA, Walker.

Cercopis circumducta, Walker, List Hom. B. M. Suppt. p. 175, (1858).

Cercopis costalis, Walker, List, l. c. iii. p. 664, (1851)-

Phymatostetha circumducta, Butler, Cist. Ent. i. p. 268, (1874).

The name *C. costalis* (l. c. iii. p. 664), had already been given to a local form of *C. theora*, White, by Walker (l. c. iii. 651) and was subsequently changed by him to *C. circumducta* for this species.

Black : head shining : frons with a semicircular luteous band which is prolonged in a conical form to the face which on each side is yellow : rostrum yellow, tip pitchy : prothorax with a luteous band along the fore border extending on each side to the base of the tegmina, scutellum lurid on each side ; pectus with large yellow marks on each side : abdomen purplish black with yellow bands at the tip, ventral surface yellow with three rows of transverse black spots, the side rows on the edge : legs tawny, femora and fore tibiæ brown, femora yellow beneath : tegmina dark brown with two narrow pale red bands, one at one-third, the other at two-thirds of the length, a yellow stripe extending along the fore-border from the base to the first band where it acquires a tawny hue, a pale red stripe extending along the hind-border from the base nearly to the first band : wings pale brown, almost colourless in part of the disc, luteous at the base, veins black (*Walker*). Body long 12 : wings long 15 millims. A variety has two subapical spots on the tegmina red.

Reported from Malabar, Singapore.

26. PHYMATOSTETHA HILARIS, Walker.

Cercopis hilaris, Walker, List Hom. B. M. iii. p. 665, (1851).

Phymatostetha costalis, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 721, (1870).

Phymatostetha hilaris, Butler, Cist. Ent. i. p. 268, (1874).

Black : head shining ; frons with a semicircular luteous band which is prolonged in a very broad conical form and occupies the disc of the face : the latter is pitchy, sides and epistoma yellow, rostrum yellow with a black tip : prothorax with a luteous band along the fore-border, extending on each side to the base of the tegmen : pectus yellow, disc black : with 2—3 black spots on each side : abdomen purple, under-side yellow with three rows of transverse black spots, the side rows on the edge which is very broad : tegmina dark brown with two narrow yellow bands : the first at one-third of the length, interrupted on the disc and marked by some dots thence to the hind border ; the second, at two-thirds of the length, slightly waved : a yellow spot on the disc between it and the tip ; a yellow stripe extending along the fore border from the base to the first band : wings greyish, tinged with brown at the tips and along the hind borders, luteous at the base. Body long 10 : exp. teg. 25 millims (*Walker*). Stål, l. c. makes this a synonym of *C. costalis*, Walker.

Reported from Malabar.

27. PHYMATOSTETHA STELLATA, Guérin.

Cercopis stellata, Guérin, Icon. Règne Anim. Texte. p. 368, (1829-44) : Stål, Ofvers. Kong. Vet. Aka. Förh. p. 150, (1865).

Cercopis dorsimacula, Walker, List. Hom. B. M. iii. p. 663, (1851) : J. L. S. Zool. i. p. 95, (1856).

Cercopis tomentosa, Walker, J. L. S. Zool. x. p. 284, (1867).

Phymatostetha stellata, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 721, (1870) : Butler, Cist. Ent. i. p. 269, (1874).

Black, dull : head with a band in front of the eyes, two spots on the disc of the thorax, the lateral margins of the thorax, a spot on each side of the scutellum at the base, eight spots on each tegmen of which one is at the base, three are costal or subcostal, three near the hind-broader and one near the tip, luteous : narrow apical limbus, lurid : wings brown, rufescent at the base, veins black. Body long 17 : exp. teg. 37 millims.

Reported from Malabar, Malacca, Sumatra : the Indian Museum possesses a specimen from Johore.

28. PHYMATOSTETHA DORSIVITTA, Walker.

Cercopis dorsivitta, Walker, List Hom. B. M. iii. p. 662, (1851).

Var. *Cercopis humeralis*, Walker, List l. c. p. 662, (1851).

Phymatostetha dorsivitta, Butler, Cist. Ent. i. p. 269, (1874).

Black slightly shining : thorax red, black on each side in front and along the hind border : thorax with three red stripes, the side pair oblique and extending on each side from the fore border to the base of the tegmina ; abdomen purple above, red at the tip and on each side : tegmina bluish brown with seven red spots, three costal or subcostal, three on hind border, and one on the disc near the tip which is lurid and occupies the apical fourth of the tegmen : wings pale brown, red at the base. Body long 18 : exp. teg. 42 millims.

Reported from N. India, Almora N. W. P., Silhat.

29. PHYMATOSTETHA PUDICA, Walker.

Cercopis pudica, Walker, Ins. Saunders. Hom. p. 84, (1858).

Phymatostetha pudica, Butler, Cist. Ent. i. p. 269, (1874).

Allied to *P. signifera*.

Reported from Silhat.

30. PHYMATOSTETHA SIGNIFERA, Walker.

Cercopis signifera, Walker, List Hom. B. M. iii. p. 655, (1851).

Tomaspis signifera, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 151, (1865).

Phymatostetha signifera, Stål, l. c. p. 721, (1870) : Butler, Cist. Ent. i. p. 270, (1874).

Blackish : frons before the middle, lobes of the vertex, a median stripe on the thorax and anterior lateral margins, scutellum, almost third basal part of the tegmina, pectus, venter, and feet stramineous : the stramineous portion of the tegmina with three irregular brown spots ; beyond these, two arched patches and a transverse patch and the apical

36. CALLITETTIX PRODUCTA, Stål.

Callitettix producta, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 153, (1865).

Black, very finely punctured; apex of scutellum, the tegmina, abdomen, and feet, reddish testaceous: frons tumid, forming a nearly straight angle, rounded at apex, without a keel: thorax hardly broader than long, lateral margins of fore part a little shorter than the anterior margin: tegmina narrow, slightly amplified towards the apex. Body long 7: exp. teg. 16 millims. ♀.

Reported from E. India.

37. CALLITETTIX VERSICOLOR, Fabr.

Cicada versicolor, Fabricius, Ent. Syst. iv. p. 50, (1794): Syst. Rhyn. p. 69, (1803).

Callitettix versicolor, Stål, Hem. Fabr. ii. p. 11, (1869).

Black shining, fuscous-pubescent; tegmina with a spot before the middle of the clavus and a subtransverse spot on the corium placed between the middle of the corium and the base, white; two spots behind the middle of the corium, the external large, transverse; the internal small, obsolete, placed at the apex of the clavus, sanguineous: wings uncoloured, apical margin slightly infuscate. Body long with the tegmina $11\frac{1}{2}$ — $12\frac{1}{2}$: breadth of pronotum 3— $3\frac{1}{2}$ millims. ♀.

Reported from Tranquebar.

Subfamily APHROPHORINA, Stål.

Aphrophorida, Stål, Hem. Afric. iv. p. 55, 66 (1866): *Aphrophorina*, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 722, (1870): Scott. E. M. M. vii. p. 241, (1871).

Anterior margin of thorax round or angular, eyes usually transverse; scutellum flat, triangular.

Genus PTYELUS, St. Fargeau & Serville.

Body very large: head somewhat narrower than the thorax or of the same breadth, short, anteriorly obtusely and roundly subangulated, entire anterior margin obtuse; frons slightly convex, transversely obsolete sulcated, clypeus not extending beyond the apex of the anterior coxæ: ocelli almost equally distant from each other and from the eyes or a little more distant: thorax finely rugose, quadrangular, anterior margin broadly rounded: scutellum longer than broad: tegmina subcultriform, narrowed towards the apex, very densely punctured: apical area of wing behind the second anastomosis posteriorly acuminate, not reaching the intramarginal vein: posterior tibiæ bispinose.

I have not transcribed the descriptions of the following species attributed to *Ptyelus* by Mr. Walker as it is very doubtful whether they would be considered as belonging to it now and no representatives apparently exist in the collection of the Indian Museum.

38. *PTYELUS CONIFER*, Walker.

Ptyelus conifer, Walker, List. Hom. B. M. iii. p. 711, (1851).

Body long 6 : exp. teg. 17 millims. Reported from N. India.

39. *PTYELUS QUADRIDENS*, Walker.

Ptyelus quadridens, Walker, List Hom. B. M. iii. p. 711, (1851).

Body long 8 : exp. teg. 17 millims. Reported from N. India, N. Bengal.

40. *PTYELUS SEXVITTATUS*, Walker.

Ptyelus sexvittatus, Walker, List Hom. B. M. iii. p. 715, (1851).

Body long $5\frac{1}{2}$: exp. teg. $12\frac{1}{2}$ millims. Reported from N. India.

41. *PTYELUS PUNCTUM*, Walker.

Ptyelus punctum, Walker, List. Hom. B. M. iii. p. 718, (1851).

Body long $5\frac{1}{2}$: exp. teg. 12 millims. Reported from N. Bengal.

42. *PTYELUS SUBFASCIATUS*, Walker.

Ptyelus subfasciatus, Walker, List. Hom. B. M. iii. p. 724, (1851).

Body long 4 : exp. teg. 8 millims. Reported from N. India.

Genus *APHROPHORA*, Germar.

Mag. Ent. iv. p. 50, (1821) : Amyot and Serville, Hist. Nat. Ins. Hém. p. 563, (1843) : Scott, E. M. M. vii. p. 271, (1870) : Fieber, Rev. Mag. Zool. (3 Sér.) iii. p. 382, (1875).

Head almost as broad as the prothorax : vertex almost horizontal and somewhat flattened ; anterior margin sometimes rounded, generally very obtusely angulated : clypeus of variable length, reaching to or beyond the first pair of coxæ : rostrum long, 2—3 jointed ; ocelli two or sometimes absent ; when present placed near the posterior margin of the vertex and more or less remote from the eyes. Pronotum hexagonal or trapezoidal with a longitudinal keel continued through the vertex ; anterior margin rounded or obtusely angulated, posterior margin frequently deeply angulate-emarginate, scutellum triangular, shorter than the thorax. Tegmina slightly coriaceous, ovally elongate, acuminate : wings with the inferior nerve furcate from the base or before the middle. Posterior tibiæ armed with 1—2 spines and a circlet of spinules at the tip.

43. *APHROPHORA SIGILLIFERA*, Walker.

Aphrophora sigillifera, Walker, List Hom. B. M. iii. p. 700, (1851),

Testaceous shining : head and thorax flat, with a slight yellow keel rudely punctured, thinly covered with tawny down : head above short mostly pitchy, slightly concave on the posterior margin, rather more convex in front ; its length less than one-fourth of its breadth ; face ferruginous, partly pitchy, slightly convex, with a very narrow yellow stripe which is most distinct towards the epistoma and is there traversed by two slightly curved yellow bands, one large, the other shorter and narrower ; on each side, are about ten oblique, slightly curved transverse ridges : rostrum ferruginous with a pitchy tip : pectus with a short, broad, black band between the fore and middle legs : abdomen luteous, reddish on each side and beneath : legs ferruginous, spotted with yellow, hind femora yellow : tegmina lurid, thickly punctured, narrow and conical towards the tips which are almost acuminate, brownish along part of the fore-border, on each side of a large subquadrate whitish spot which is in the middle : wings almost colourless, veins black, tawny at the base (*Walker*). Body long 7 : wings long 15 millims.

Reported from N. India.

Genus *CLOVIA*, Stål.

Hem. Afric. iv. p. 68, 75 (1866) : Ofvers. Kong. Vet. Aka. Förh. p. 723, (1870).

Head as broad as the thorax, rounded or roundly subangulated, varying in length, above flat, anterior margin of the lobes of the vertex acute, not furrowed ; frons somewhat convex, clypeus moderately produced at the apex, not extending beyond the apex of the anterior coxæ : position of ocelli variable : thorax sexangular with the anterior lateral margins usually very short, parallel or very slightly diverging backwards, scutellum longer than broad : tegmina with the commissural margin beyond the apex of the clavus subangulated or a little rounded : posterior tibiæ bispinose (*Stål*).

44. *CLOVIA GUTTIFER*, Walker.

Ptyelus guttifer, Walker, List Hom. B. M. iii. p. 712, (1851).

Clovia guttifer, Stål, Hem. Afric. iv. p. 75, (1866).

Lurid : head and thorax flat, finely punctured, thickly tawny pubescent ; head with a short yellow band and two black dots on fore-border ; face yellow, with a flat, middle stripe, on each side of which are nine oblique very shallow ridges, spaces between them tawny ; rostrum tawny with a black tip ; abdomen luteous, pectus and legs yellow : tips of the spines and feet pitchy : tegmina ferruginous, thickly covered with tawny

down, with two oblique whitish stripes on the fore-border near the tip where there is a black dot; first stripe broad, second very small, a black dot on the hind-border near the tip and a few whitish streaks along the veins: wings colourless, veins black, tawny towards the base. Body long $6\frac{1}{2}$: exp. teg. 15 millims.

Reported from N. Bengal.

45. CLOVIA NEBULOSA, Fabricius.

Cercopis nebulosa, Fabr., Syst. Ent. iv. p. 50, no. 14, (1794): Syst. Rhyn. p. 94, (1803).

Clovioa nebulosa, Stål, Hem. Fabr. ii. p. 16, (1869).

Very pale yellowish-grey: two small median black spots on the head: tegmina obscurely fuscous, a very oblique anterior band, a somewhat large median spot varied with fuscous at the commissure, an obliquely transverse spot behind the middle of the costal margin and a minute costal spot towards the apex, yellowish grey: two narrow median stripes abbreviated before the middle and a lateral subtriangular spot on the thorax also lateral limb of scutellum, fuscous. Long with tegmina, 10; breadth of pronotum 3 millims.

Reported from E. India.

Genus CARYSTUS, Stål.

Berlin Ent. Zeitschr., vi. p. 303 (1862): Hem. Afric. iv. p. 69, 81 (1866).

Head as broad or almost as broad as the thorax, obtusely angulated; lobes of the vertex transversely impressed at the apex or furnished with a transverse ridge near the apex; frons slightly convex: rostrum short: thorax quadrangular or sexangular, in the latter case anterior lateral margins short: scutellum long, much longer than broad: tegmina membranous, pellucid, margined at the apex, obliquely roundly subtruncate at the apex: posterior tibiæ bispinose, upper spine sometimes very minute.

46. CARYSTUS VIRIDICANS, Stål.

Ptyelus viridicans, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 251 (1854): Freg. Eng. resa, Hem. p. 286 (1859).

Carystus viridicans, Spangberg, Ofvers. Kong. Vet. Aka. Förh. No. 9, p. 13 (1877).

Weakly olive-green, below with the feet still weaker: vertex and thorax anteriorly weakly rufous-testaceous: tegmina olive-yellow, hyaline: spines of the posterior feet black at the apex.

Body long 5: breadth of pronotum 2 millims. Reported from Java, Malacca, Singapore, Tenasserim (?).

Subfamily MACHÆROTINA, Stål.

Machærotida, Stål, Hem. Afric. iv. p. 55 (1866): *Machærotina*, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 727 (1870).

Anterior margin of thorax round or angular, eyes usually transverse: scutellum much elevated, compressed posteriorly, furnished with a long apical spine.

Genus MACHÆROTA, Burmeister.

Handb. Ent. ii. (i) p. 128 (1835).

Head small, frons tumid, confluent with the vertex, furrowed in the middle, elevated at the posterior margin, bearing the two ocelli which are approximate: basal joints of antennæ large, terminal setæ long, fine, curved: pronotum septangular, arcuate: scutellum larger, produced backwards with a median longitudinal groove which is continued into a long, pointed, acute upwardly, curved downwardly, sabre-like process: tegmina hyaline, with seven cells at the apex and a large middle cell surrounded by a forked vein: legs simple, hinder tibiæ and two first joints of the tarsi with a circlet of spinules.

47. MACHÆROTA ENSIFERA, Burmeister.

Machærota ensifera, Burm. Handb. ii. i. p. 128 (1835): Walker, List Hom. B. M. iii, p. 729 (1851): Stål, Ofvers. Kong. Vet. Aka. Förh. p. 727 (1870): Signoret, A. S. E. F. (5 Sér.), ix, p. xlviii. (1879).

Light yellow with the second and third segments above, the median part of the frons, a space on each side of the metanotum and the origin of the process, black: tegmina and wings hyaline, the base of the tegmina and the claval portion of the wings, fuscous: tegmina with five apical cells of which three lie towards the margin; above these, which gradually diminish in size, is a row of hyaline dots, on the margin itself: there are five brownish streaks on the prothorax of which the two median lateral ones are continued on the metanotum. Long 4 millims. ♂.

Reported from Philippines, Silhat.

48. MACHÆROTA SPANGBERGI, Signoret.

Machærota spangbergi, Signoret, A. S. E. F. (5 Sér.), ix, p. xlviii. (1879).

Yellowish brown; the median part of the frons, the tip of the abdomen above and the genital organs, black; feet brownish, posterior tibiæ yellow with the tips black. Differs from *M. ensifera* in having the frontal grooves black and the tegmina longer and less rounded at the tip. Long 4 millims. ♀.

Reported from Silhat.

49. MACHÆROTA PUNCTULATA, Signoret.

Machærota punctulata, Signoret, A. S. E. F. (5 Sér.), ix. p. xlix. (1879).

Brownish yellow, with the middle of the frons, the abdomen above (except the base), the feet (except the posterior tibiæ), and the frontal grooves, black; several transverse black spots on the thorax which is very finely punctured: metanotum brownish with two yellow, lateral, basal spots, the tip and the process blackish: tegmina elongate, five-celled and above the marginal two to three others smaller, very distinct: the hyaline nervures are spotted with several brown dots. Long 4 millims. ♀.

Reported from Silhat.

NOTE. *Cosmopsaltria abdulla*, Distant, noticed as No. 57 at page 226 of the Journal for 1884 is the same as *Cosmopsaltria spinosa*, Fabricius, No. 59. The Indian Museum possesses a specimen of *Cosmoscarta siamensis*, Butler, but the locality being uncertain, it has not been entered here.



III.—*On Observations of the Solar Thermometer at Lucknow.*—By
S. A. HILL, B. Sc., A. R. S. M., Meteorological Reporter North-
Western Provinces and Oudh.

[Received 23rd March 1885;—Read 6th May 1885.]

In the volume of this Journal for 1883,* I have discussed some observations of solar radiation made at Allahabad with the ordinary black-bulb maximum thermometer *in vacuo*. The conclusions drawn from these were that the absorbing power of the atmosphere is dependent upon the tension of aqueous vapour and the quantity of dust suspended in the air, pure dry air being very diathermanous; and that, when allowance is made for the variations of aqueous vapour, the mean results for the heating power of the sun during the years 1876—1882 exhibit a very uniform and gradual variation, culminating in 1878 and gradually decreasing afterwards, therefore presumably having an inverse relation to the number of spots on the sun's surface. The resulting variation is so regular in its character that, irrespective of its pointing to a conclusion regarding the sun's heat which is the reverse of that gene-

* Vol. li. Part ii.

rally held by solar physicists, I have always looked upon it as doubtful, and probably due in part to some fortuitous combination of errors. I therefore intend on some future occasion, possibly after the end of the present year, when the position of the thermometer at Allahabad will be changed, to go over the figures again, taking a longer series of observations and making allowance for a cause of variation from month to month, namely, the elliptic form of the earth's orbit, which was neglected in the paper referred to. Meanwhile, I wish to lay before the Society the results of some other observations bearing on the same question, which tend to confirm the conclusions arrived at in my previous paper. To the method by which these results are attained, less exception can be taken, because they are in every case derived from several observations made on the same day under different degrees of obliquity of incidence, instead of upon the single record of a self-registering instrument.

Shortly after hourly observations on four days in each month were commenced at Lucknow, it was discovered that the solar thermometer in use at that station had ceased to be self-registering. A new instrument was therefore brought into use on ordinary days, but the old one was retained for the hourly observations. The records of all such observations of this instrument since the middle of the year 1876 have been filed, but for the purposes of the present paper I have used only those of the eight years 1877—1884 inclusive. At Agra, similar observations of a non-registering solar thermometer have been made for some years on hourly observation days, but, owing to a change of instrument, the register for the years 1877—1884 is broken. For this reason, and because the observatory at Agra is situated in the midst of the city, I have not thought it worth while to reduce the registers of that station, though they seem to confirm in a general way the results obtained from Lucknow.

Those parts of the Lucknow records which have been used for the purposes of the present paper are printed in Table I. The figures represent for each hour of observation the difference between the temperature of the black-bulb thermometer in the sunshine and the simultaneous temperature in the shade. Only those hours are given at which the sky was either quite free from cloud or at which the cloud proportion did not exceed 2-10ths of the expanse. In the months of July and August, very few clear days, thus defined, occur; consequently these months have been left out in drawing up the tables. For every other month in the eight years, except September 1878 and June 1880, there are some observations available.

TABLE I.—*Excess Temperatures of Insolation on clear, or nearly clear, days at Lucknow.*

	Hours of observation, Mean Time.								
	8	9	10	11	12	13	14	15	16
January, 1877...7th	23·9	43·3	51·0	52·1	56·1	...	...	42·4	29·1
14th	41·1	51·0	59·5	...	...	...	...	...	...
21st	41·5	52·5	57·5	60·7	57·8	56·6	53·6	50·1	40·1
28th	...	...	...	...	...	...	...	...	...
February.....7th	...	...	...	...	...	...	...	...	...
14th	42·0	53·8	55·0	57·3	62·8	57·7	55·3	46·4	42·1
21st	...	...	...	...	...	...	...	...	...
28th	44·0	54·1	58·8	59·4	59·6	58·9	55·8	51·1	45·4
March.....7th	42·0	54·1	58·6	59·1	58·9	58·1	55·1	47·9	39·1
14th	38·1	52·1	58·1	56·1	54·6	54·1	52·6	...	...
21st	...	...	...	...	...	...	...	...	...
28th	...	...	...	...	...	56·1	52·9	49·6	41·9
April.....7th	...	...	...	...	...	...	...	...	...
14th	47·1	53·6	57·6	58·1	57·1	55·0	52·8	...	...
21st	48·1	53·1	56·1	56·5	57·0	55·5	54·0	50·7	44·5
28th	...	...	...	...	...	...	...	...	...
May.....7th	...	...	...	...	...	...	...	52·1	44·9
14th	...	55·8	55·8	57·0	56·0	57·0	54·5	49·5	42·0
21st	47·3	52·0	55·0	57·7	54·0	...	...	49·5	38·3
28th	40·3	48·3	53·0	57·0	58·0	54·8	55·0	50·0	41·8
June.....7th	...	...	...	...	...	...	...	...	...
14th	42·9	49·5	56·0	55·5	56·7	55·7	55·5	49·0	36·8
21st	38·8	50·0	55·0	...	...	...	...	41·0	35·0
28th	...	...	...	...	...	...	...	...	...
September.....7th	...	45·9	53·1	...	57·3	...	...	...	...
14th	38·4	47·9	50·0	56·5	56·0	...	...	...	...
21st	40·9	47·8	49·3	51·8	53·8	...	...	...	...
28th	37·1	45·1	46·5	53·3	54·0	...	51·0	47·0	35·5
October.....7th	...	...	...	...	...	...	...	...	...
14th	43·6	48·9	53·6	55·4	56·1	54·4	50·3	45·1	35·1
21st	38·1	43·6	46·4	48·1	50·1	48·6	...	...	32·1
28th	40·1	46·4	54·6	56·4	56·4	52·6	48·6	41·6	29·6
November.....7th	...	...	...	...	...	...	...	...	...
14th	35·7	49·4	...	58·1	58·1	55·6	54·1	47·4	18·6
21st	...	44·1	51·4	56·4	57·9	57·6	50·4	44·3	20·3
28th	...	...	...	...	...	...	...	...	...
December.....7th	...	...	...	...	...	...	...	...	...
14th	41·5	52·3	56·3	54·5	53·5	52·0	48·5	44·7	11·0
21st	39·3	47·0	...	...	...	48·0	40·8	32·8	12·3
28th	...	...	...	...	...	...	...	...	...